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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/813,692	03/21/2001	Yutaka Shimizu	2500.65339	3442

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EXAMINER
UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 09/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/813,692	Applicant(s) SHIMIZU ET AL.
	Examiner Nikolas J. Uhlir	Art Unit 1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) *7-10* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 11-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. This office action is in response to the amendment/arguments dated 7/17/03. The amendment is considered by the examiner to be sufficient to overcome the rejections contained in the prior office action. Accordingly these rejections are hereby withdrawn. However, the case is not in condition for allowance in light of the new grounds of rejection presented below.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Singleton et al. (US2002/0012207A1).

4. The limitations of claim 1 require a magnetoresistive film comprising an antiferromagnetic layer, a first pinned magnetic layer superposed on the antiferromagnetic layer, a base interfacial roughness being formed betweewn the antiferromagnetic layer and the first pinned magnetic ferromagnetic layer; an antiferromagnetic bonding layer superposed on the first pinned magnetic layer, an antiferromagnetic bonding layer on the first pinned magnetic layer, a second pinned magnetic layer on the antiferromagnetic bonding layer, a non magnetic layer on the

second pinned magnetic layer, a free magnetic layer on the non-magnetic layer, and a compound existing between the antiferromagnetic layer and the second pinned magnetic layer.

5. For the purpose of this examination, the examiner is interpreting the phrase "superposed on" as open language that allows for layers other then those recited to be present in the film. Further, "superposed on" is not interpreted to mean that the layers must be "in direct contact" or "directly adjacent to" one another. The examiner also interprets the phrase "antiferromagnetic bonding layer" to not necessarily require that the layer between the antiferromagnetic layer and the second pinned layer be antiferromagnetic. This interpretation is valid as the applicant on page 15 of the instant specification describes the use of Ru (a known non magnetic material) as the Antiferromagnetic bonding layer. The examiner also interprets that the limitation of "a compound existing between the antiferromagnetic layer and the second pinned layer" to allow for the "compound" to be contained within the antiferromagnetic bonding layer. Although the examiner acknowledges that this structure does not appear to be disclosed by the applicant in the specification, the examiner respectfully reminds the applicant that while the claims are interpreted in light of the specification, it is the duty of the examiner to give the claims their "broadest reasonable interpretation" without reading limitations present in the specification into the claims. Last, it should be noted that the examiner hereafter utilizes AFM as an acronym for "antiferromagnetic."

6. Bearing the above interpretation in mind, with respect to the limitations of claim 1, Singleton et al. (hereafter Singleton) teaches one embodiment of a magnetoresistive

film that comprises a first AFM layer 309 (equivalent to applicants claimed AFM layer), a first pinned layer 308 (equivalent to applicants first pinned layer), an AFM coupling layer 307, a specular scattering layer 305 (equivalent to applicants claimed "compound", a reference layer 304 (equivalent to applicants claimed 2nd pinned magnetic layer), a spacer layer 303, and a free magnetic layer 302 (equivalent to applicants claimed free magnetic layer) formed in that order (figure 3b). The AFM coupling layer is formed from Ru (page 3 section 2). As Ru is identical to the material utilized by the applicant, the examiner takes the position that the Ru AFM coupling layer of Singleton is equivalent to applicants claimed AFM bonding layer. Further, Singleton teaches that the spacer layer 303 is an alloy of Cu (page 2, section 25), and is thus non-magnetic. Thus, the limitations of claim 1 are met.

7. Further, Singleton teaches a 2nd embodiment of a magnetoresistive film that comprises an AFM layer 309 (equivalent to applicants claimed AFM layer), a pinned layer 308 (equivalent to applicants claimed 1st pinned magnetic layer), a codeposited AFM/specular scattering layer 320 (equivalent to applicants claims AFM bonding layer and the applicants claimed compound between the AFM layer and the 2nd pinned magnetic layer), a reference layer 320 (equivalent to applicants claimed 2nd pinned magnetic layer), a spacer layer 303 (equivalent to applicants claimed spacer), and a free magnetic layer 302 (equivalent to applicants claimed free layer) formed in this order (figure 3c).

8. Regarding the limitation in claim 1 requiring a base interfacial roughness to be formed between the antiferromagnetic layer and the first pinned magnetic layer, and an

interfacial roughness smaller then the base interfacial roughness between the second pinned magnetic layer and the non-magnetic spacer layer. Also Singleton does not teach or address these limitations, it is the examiners position that these limitations are necessarily met by this reference, as the magnetoresistive film exhibits substantially the same structure as that required by the instantly claimed film, and is formed from substantially similar materials as that of the instantly claimed film.

9. The applicant is respectfully reminded that it has been held that where claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily on inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not. Therefore, the *prime facie* case can be rebutted by ***evidence*** showing that the prior art products do not necessarily possess the characteristics of the claimed product. Absent a showing that the structure of Singleton does not necessarily possess the required roughness characteristics, this rejection is maintained.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claim 2-3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singleton et al. as applied to claim 1 above, and further in view of Miyauchi et al. (EP0749112A2).

12. Singleton is relied upon as stated above for claim 1. Further, it is noted that Singleton teaches that suitable materials for forming the AFM layers include PtMn, NiMn, IrMn, or PtCrMn.

13. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to select NiMn as the material for forming the AFM layer 306 in Singleton, as this material is recognized to be equivalent to the other materials listed as suitable for this purpose.

14. The applicant is respectfully reminded that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency.

15. However, Singleton does not teach that the AFM layer is a polycrystalline layer of a regulated lattice structure, as required by claim 2.

16. With respect to this deficiency, Miyauchi et al. (hereafter Miyauchi) teaches a spin valve utilizing NiMn as an AFM layer. Miyauchi teaches that in order to obtain good antiferromagnetic characteristics from a NiMn layer, the film must be annealed in the presence of a magnetic field such that θ phase NiMn forms in the layer.

17. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to heat treat the NiMn AFM layer utilized by Singleton per the method taught by Miyauchi.

18. One would have been motivated to make this modification due to the teaching in Miyauchi that in order for NiMn to exhibit good AFM properties, it must be heat treated in the presence of a magnetic film.

19. While the examiner acknowledges that Miyauchi does not teach that heat treating the NiMn layer results in a polycrystalline layer having a regulated lattice structure, the method disclosed by Miyauchi is very similar to the method described on page 5 of the specification wherein the applicant describes a heat treating the "material layer" to transition the material layer from a face centered cubic structure to a face centered tetragonal structure. Further, NiMn is listed by the applicant on page 13 of the specification as a suitable material for forming the AFM layer. Thus, the examiner takes the position that the NiMn layer formed by the method described by Miyauchi is equivalent to the applicants claimed polycrystalline layer having a regulated lattice structure.

20. The applicant is respectfully reminded that is has been held that where claimed and prior art products are identical or substantially identical in structure or composition, **or are produced by identical or substantially identical processes**, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily on inherently possess characteristics of claimed products where the rejection is based on inherency

under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not. Therefore, the *prime facie* case can be rebutted by ***evidence*** showing that the prior art products do not necessarily possess the characteristics of the claimed product.

21. Regarding the limitations of claim 3, wherein the applicant requires the claimed "compound" to be an oxide, nitride, sulfide or carbide. Singleton teaches that the specular scattering layer 305 is typically formed from an oxide selected from Y_2O_3, HfO_2, MgO, Al_2O_3, NiO, Fe_2O_3, or Fe_3O_4 (page 2, section 25). Thus, this limitation is met.

22. Regarding claim 4, wherein the applicant requires the oxide, nitride, sulfide, or carbide required by claim 3 to be a compound consisting of an element included in the antiferromagnetic bonding layer and oxygen, sulfur, nitrogen, or carbon. The examiner takes the position that this limitation is met by the second embodiment of the magnetoresistive film taught by Singleton as described above for claim 1. In this embodiment, Singleton teaches the use of a composite specular scattering/AFM coupling layer, wherein the composite AFM/specular scattering layer is formed by co depositing Ru, Rh, Cr, or a mixture of these elements with an oxide such as Y_2O_3, HfO_2, MgO etc... (page 3, section 33). In this particular embodiment, the examiner takes the position that this composite AFM coupling layer is equivalent to applicants claimed AFM bonding layer (by containing Ru, Rh, or Cr), and contains the applicants claimed

compound (the oxide) existing between the antiferromagnetic layer and the 2nd pinned magnetic layer. As the oxide is an oxide of an element "included" in the antiferromagnetic coupling layer, the limitations of claim 4 are met.

23. The limitations of claim 5 require that the AFM coupling layer be formed to a thickness between 0.5-0.9nm. With respect to these limitations, Singleton teaches in the second embodiment of the magnetic resistive film that the composite AFM/specular scattering layer has a thickness of 0-8 angstroms. As 8 angstroms is equivalent to 0.8nm, the limitations of claim 5 are met.

24. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singleton as modified by Miyauchi as applied to claim 2 above, and further in view of Maeda et al. (US5955211).

25. Regarding claims 11 and 12 wherein the applicant requires a first ferromagnetic crystal layer; an antiferromagnetic bonding layer formed on the first ferromagnetic crystal layer based on epitaxy; a second ferromagnetic crystal layer formed on the epitaxial antiferromagnetic bonding layer based on epitaxy; and a compound existing between the AFM bonding layer and the second ferromagnetic crystal layer (claim 11), wherein the compound is an oxide, nitride, carbide, or sulfide (claim 12).

26. The limitation "based on epitaxy" in claim 11 is a product-by-process limitation and is does not appear to be further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-

by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113.

27. Regarding the limitations of claims 11 and 12, the bulk of these limitations are met by the combination of Singleton with Miyauchi as described above. However, the examiner acknowledges that neither Singleton nor Miyauchi disclose the use of crystalline ferromagnetic layers. However, it is noted that Singleton teaches a specific embodiment wherein a synthetic AFM layer is formed utilizing a layer of CoFe/Ru/Specular Scattering/CoFe. The examiner takes the position that the requirements of crystalline ferromagnetic layers are met when CoFe is utilized, as this material is known to be crystalline, as shown by Maeda et al. (claim 3).

28. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singleton as modified by Miyauchi and Maeda as applied to claim 12 above, and further in view of Lai et al. (US2001/0012187A1)

29. Singleton as modified by Miyauchi and Maeda as applied to claim 12 above does not teach a utilizing a compound between the AFM bonding layer and the 2nd ferromagnetic crystal layer wherein the compound consists of an element included in the AFM bonding layer and the O, N, S, or C, as require by claim 12.

30. However, it is noted that Singleton teaches that for the specular scattering layer 305, suitable materials include Y_2O_3, HfO_2, Al_2O_3, NiO, Fe_2O_3, and Fe_3O_4 (page 2, section 23).

31. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to select Fe_2O_3 or Fe_3O_4 as the material for the specular scattering layer 305, as these materials are recognized to be equivalent to the other materials listed as suitable for this purpose.

32. With respect to the deficiencies of Singleton as modified by Miyauchi and Maeda in regards to the limitations of claim 13, Lai et al. teaches a synthetic antiferromagnetic material that comprises a first ferromagnetic layer, a nonmagnetic spacer layer on the first ferromagnetic layer, and a second ferromagnetic layer on the non-magnetic spacer. FeSi is utilized as the non-magnetic spacer layer (page 3, section 33).

33. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute FeSi as taught by Lai et al. for the Ru spacer layer utilized by Singleton et al. as FeSi and Ru are recognized to be equivalent for use as non-magnetic spacer layers in synthetic antiferromagnetic structures.

34. It is the examiners position that the limitations of claim 13 are met when FeSi is utilized as the non-magnetic spacer and either Fe_2O_3 or Fe_3O_4 are utilized as the specular scattering layers in the structure of Singleton.

35. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gill et al. (US6181534) in view of Singleton et al. (US2002/0012207A1)

36. Regarding the limitations of claim 1, Gill et al. (hereafter Gill), teaches a specific embodiment of a spin valve sensor that comprises a pinning NiMn layer 402 (equivalent to applicants claimed AFM layer), a first Co pinned film 416 (equivalent to applicants

claimed first pinned ferromagnetic layer), a non magnetic Ru spacer layer 414 (equivalent to applicants claimed AFM bonding layer), a second Co pinned film 418 (equivalent to applicants claimed second pinned ferromagnetic film), a nonmagnetic Cu spacer 410 (equivalent to applicants claimed nonmagnetic spacer layer), and a free NiFe layer 408 (equivalent to applicants claimed free ferromagnetic layer) (figure 11 and column 6, lines 20-50).

37. However, Gill does not teach a compound existing between the antiferromagnetic layer and the second pinned magnetic layer, as required by claim 1. Further, Gill does not teach the roughness requirements of claim 1.

38. With respect to this deficiency, Singleton teaches the addition of specular scattering layers to a synthetic antiferromagnetic spin valve (analogous to the 1st pinned/Ru spacer/2nd pinned structure in Gill) in order to improve the giant magnetoresistive effect exhibited by the structure (page 2, section 20). Singleton teaches that the specular reflection layer may be formed of an oxide of Y, Hf, Mg, Al, Ni, or Fe, and may be suitably placed between the spacer and the 2nd pinned magnetic film in a synthetic antiferromagnetic structure (pages 2 and 3, sections 23 and 31-33, and figure 3b).

39. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a specular scattering layer of an oxide of Y, Hf, Mg, Al, Ni or Fe as taught by Singleton between the Spacer layer 414 and the second pinned layer 418 in Gill.

40. One would have been motivated to make this modification due to the teaching in Singleton that synthetic antiferromagnetic spin valves utilizing specular reflection layers between the spacer layer and the 2nd pinned magnetic layer exhibited enhanced giant magnetoresistive effects.

41. Regarding the applicants claimed roughness requirements. Although Gill as modified by Singleton do not explicitly teach this requirement, the examiner takes the position that the applicant's claimed base interfacial roughness and interfacial roughness between the 2nd pinned layer and the non-magnetic spacer is necessarily met by this combination. The combination of Gill with Singleton results in a magnetoresistive film having substantially the same structure as that of the instantly claimed film, and utilizes substantially the same materials as that of the instinatly claimed film.

42. The applicant is respectfully reminded that it has been held that where claimed and prior art products are identical or substantially **identical in structure or composition, or are produced by identical or substantially identical processes**, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily on inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not. Therefore, the *prime facie* case can be rebutted by ***evidence***

showing that the prior art products do not necessarily possess the characteristics of the claimed product. Absent such a showing, this rejection is maintained.

43. Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gill as modified by Singleton as applied to claim 1 above, and further in view of Miyauchi et al.

44. Gill as modified by Singleton does not teach the use of an antiferromagnetic layer that is a polycrystalline layer of a regulated lattice structure, as required by claim 2.

45. However, it is noted that Gill teaches the use of NiMn as the pinning layer 402. Further, Miyauchi teaches a spin valve utilizing NiMn as an AFM pinning layer. Miyauchi teaches that in order to obtain good antiferromagnetic characteristics from the NiMn layer, the film must be annealed in the presence of a magnetic field such that θ phase NiMn forms in the layer.

46. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to heat treat the NiMn AFM layer utilized by Singleton per the method taught by Miyauchi.

47. One would have been motivated to make this modification due to the teaching in Miyauchi that in order for NiMn to exhibit good AFM properties, it must be heat treated in the presence of a magnetic film.

48. While the examiner acknowledges that Miyauchi does not teach that heat treating the NiMn layer results in a polycrystalline layer having a regulated lattice structure, the method disclosed by Miyauchi is very similar to the method described on page 5 of the specification wherein the applicant describes a heat treating the "material layer" to

transition the material layer from a face centered cubic structure to a face centered tetragonal structure. Further, NiMn is listed by the applicant on page 13 of the specification as a suitable material for forming the AFM layer. Thus, the examiner takes the position that the NiMn layer formed by the method described by Miyauchi is equivalent to the applicants claimed polycrystalline layer having a regulated lattice structure.

49. The applicant is respectfully reminded that is has been held that where claimed and prior art products are identical or substantially identical in structure or composition, **or are produced by identical or substantially identical processes**, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily on inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not. Therefore, the *prime facie* case can be rebutted by ***evidence*** showing that the prior art products do not necessarily possess the characteristics of the claimed product. Absent such a showing, this rejection is maintained.

50. Regarding the limitations of claim 3, these limitations are met as set forth above for claim 1.

51. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gill as modified by Singleton and Miyauchi as applied to claim 3 above, and further in view of Lai et al. (US20010012187A1).

52. Gill as modified by Singleton fails to teach utilizing a compound that comprises an oxide, nitride, sulfide or carbide or an element included in the AFM bonding layer, as required by claim 4.

53. However, it is noted that Singleton (as stated above) teaches that oxides of Y, Hf, Mg, Al, Ni, or Fe are suitable for use as specular reflection layers.

54. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize an oxide of Fe as the specular reflection layer material, as this material is recognized to be equivalent to the other materials listed as suitable for this purpose.

55. Further, Lai et al. teaches a synthetic antiferromagnetic material that comprises a first ferromagnetic layer, a nonmagnetic spacer layer on the first ferromagnetic layer, and a second ferromagnetic layer on the non-magnetic spacer wherein FeSi is utilized as the non-magnetic spacer layer (page 3, section 33).

56. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute FeSi as taught by Lai et al. for the Ru spacer layer utilized by Gill et al. as FeSi and Ru are recognized to be equivalent for use as non-magnetic spacer layers in synthetic antiferromagnetic structures.

57. It is the examiners position that the limitations of claim 4 are met when FeSi is utilized as the non-magnetic spacer and an oxide of Fe is utilized as the specular scattering layers in the structure of Gill as modified by Singleton.

58. Regarding the limitations of claims 5 and 6, wherein the applicant requires the AFM bonding layer to be between 0.5-0.9nm (claim 5), and the non-magnetic spacer to be between 1.9-2.3nm (claim 6). Figure 11 of Gill utilizes and spacer layer 414 of Ru that is 6 angstroms (0.6nm) thick, and a spacer layer 410 of Cu that is 20 angstroms (2nm) thick. Thus, the limitations of claims 5 and 6 are met.

59. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gill as modified by Singleton, Miyauchi and Lai as applied to claims 2 and 4 above, and Kamiguchi et al. (US6088195).

60. The limitation "based on epitaxy" in claim 11 is a product-by-process limitation and is does not appear to be further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113.

61. Gill as modified by Singleton, Miyauchi and Lai as applied to claims 2 and 4 above teaches the bulk of the limitations of claims 11. However, it is acknowledged that

this combination of references does not explicitly teach the use of crystalline ferromagnetic layers, as required by claim 11.

62. However, Co is known in the art to be a crystalline material, as shown by Kamiguchi et al. (column 2, lines 63-66). Thus, as Gill specifically utilizes Co as the first and 2nd pinned ferromagnetic films 416 and 418, the examiner takes the position that the limitations of claim 11 are met.

63. Regarding the limitations of claims 12-13, these limitations are met as set forth above for claims 2, 4, and 11.

Response to Arguments

64. Applicant's arguments filed 7/17/03 have been fully considered but they are moot in view of the new grounds of rejection presented above.

Conclusion

65. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

NJU
nju

Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700